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Brent A. Pringnitz
Iowa State University, bpring@iastate.edu

Robert G. Hartzler
Iowa State University, hartzler@iastate.edu

TOO MUCH OF A GOOD THING: A LOOK AT HERBICIDE CARRYOVER AND MODE OF ACTION

Brent A. Pringnitz and Robert G. Hartzler
Extension Program Specialist and Extension Weed Specialist
Department of Agronomy
Iowa State University

Several herbicides commonly used in Iowa corn and soybean production have sufficient persistence for soil residues to remain into the following spring. The shortage of rainfall across much of Iowa during the 2000 growing season may result in higher concentrations of these herbicides in 2001 than normally encountered, thus increasing the possibility of herbicide injury to rotational crops.

Several factors influence the longevity of herbicides, including soil characteristics, application rate, date of application and environmental conditions. The longevity of triazine and sulfonylurea herbicides increases greatly when soil pH exceeds 7.0. Injury from these herbicides is usually closely associated with pH changes across the field. The later a herbicide is applied in the growing season, the greater the potential for damaging residues to remain in the soil. This was demonstrated this spring with Flexstar carryover. Most problems encountered with this herbicide were associated with applications made in late June of 1999.

The potential for carryover injury to rotation crops is influenced not only by the amount of herbicide present in the soil, but also on the susceptibility of the rotational crop and early-season growing conditions. Because of these interacting factors, it is difficult to accurately predict the likelihood of injury occurring in a specific field. A farmer can minimize risks of problems in fields suspected of having carryover potential by reducing other stresses that might weaken the crop during establishment. Avoiding very early planting dates, selecting hybrids/varieties with good early-season vigor, and selecting herbicides with high margins of crop safety can reduce the risk of carryover problems. Increased tillage has not consistently reduced problems associated with low levels of herbicide residues, particularly systemic products such as the ALS inhibitors.

Avoid the use of herbicides with the same mode of action as the herbicide suspected to pose a carryover risk. The amount of herbicide remaining in the soil from last year's application may be insufficient to pose a threat to a rotational crop. However, if a second herbicide with the same mode of action is applied to the field, the additive effect of last year's residues and the current herbicide may overwhelm the crop's defense system. For example, if soybeans were treated with Canopy in 2000, use of a product such as Hornet or Basis on corn in 2001 might result in an additive effect from the multiple ALS inhibitors (Canopy – chlorimuron; Hornet – flumetsulam; Basis – thifensulfuron and rimsulfuron).

In summary, while widespread problems from herbicide carryover are not expected in 2001, the shortage of rainfall during 2000 may result in problems for some growers. The following tables provide information on persistent herbicides that can pose a treat to rotational crops. This information can be used to access the risks in specific fields and modify plans for the upcoming season to minimize the risk of problems.

Table 1. Characteristics of persistent soybean herbicides.

Product	Product/A	a.i. of concern	a.i./A	pH[1]	Degrad. pathway[2]	Rotation Interval[3] (Months)		Comments
						Corn	Alfalfa	
Authority	4 oz	sulfentrazone	3 oz	+	C	10	12	Availability increases with pH > 6.8.
Canopy	16 oz	chlorimuron	1.7 oz	+	C	10	10	Do not use of fields with composite pH >6.8
Canopy XL	6.8 oz	chlorimuron sulfentrazone	0.6 oz 3.2 oz	+	C	10	12	Do not use of fields with composite pH >6.8
Classic	0.5 oz	chlorimuron	.125 oz	+	C	9	9-12	
Command 3ME	2 pt	clomozone	0.75 lb	-	C	9	12	
Commence	2.5 pt	trifluralin clomozone	0.94 lb 0.70 lb	o -	C C	9	15	
Concert	0.5 oz	chlorimuron	0.06 oz	+	C	9	9	
Extreme	3 pt	imazethapyr	1.0 oz	o	M	8.5	4	
Flexstar	1 pt	fomesafen	0.25 lb	o	C	10	18	Use only in alternate years. Max. of 1.3 pt/year.
Reflex	1 pt	fomesafen	0.25 lb	o	C	10	18	Use only in alternate years. Max. of 1.0 pt/year.
Prowl 3.3E	3 pt	pendimethalin	1.2 lb	o	C	9	9	
Pursuit DF	1.44 oz	imazethapyr	1.0 oz	o	M	8.5	4	
Pursuit Plus	2.5 pt	imazethapyr pendimethalin	0.84lb 1.0 oz	o o	M C	8.5	9.5	
Scepter 70 DG	2.8 oz	imazaquin	2.0 oz	o	M	9.5 – 18	18	Interval dependent upon rate, location and rainfall.
Squadron	3 pt	imazaquin	2.0 oz	o	M	9.5-18	18	Interval dependent upon rate, location and rainfall.
Steel	3 pt	imazethapyr imazaquin	1.0 oz 1.0 oz	o	M	9.5 – 18	18	Interval dependent upon rate, location and rainfall.
Synchrony STS	0.5 oz	chlorimuron	0.16 oz	+	C	9	12	
Treflan MTF	2 pt	trifluralin	1 lb	o	C	-	-	

[1] + indicates persistence and/or availability as pH increases; - indicates persistence and/or availability decreases as pH increases; o = indicates that soil pH does not significantly influence persistence and/or availability.

[2] Primary method of herbicide degradation: C = chemical; M = microbial. Both mechanisms are slowed when soil moisture is limited, but persistence of herbicides degraded primarily by microbial activity will increase more than herbicides degraded chemically during dry conditions.

[3] The rotation interval specified on some labels may vary according to location in the state; soil type, use rate or use of other herbicides. Check current labels for specific information concerning rotation restrictions.

Table 2. Characteristics of persistent corn herbicides.

Product	Product/A	a.i. of concern	a.i./A	pH[1]	Degrad pathway[2]	Rotation Interval (Months)[3]		Comments
						Soybean	Alfalfa	
atrazine 90 DF	1.1 lb	atrazine	1.0 lb	+	C	9	18	Present in many tank mixes (Table 3).
Exceed	1.0 oz	prosulfuron	0.28 oz	+	C	18	18	
Hornet	2.4 oz	clopyralid	1.5 oz	o	M	10.5	10.5	Do not plant soybeans or alfalfa for 18 months if less than 15" rain occurs and soil has less than 2% O.M.
Princep 90DF	1.1	simazine	1.0 lb	+	C	9	18	
Spirit	1.0 oz	prosulfuron	0.14 oz	+	C	18	18	10 month restriction for soybeans in counties south of I-80 with pH below 7.8

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Table 3. Atrazine premixes.

Product	Rate	lb atrazine/A
Basis Gold	14 oz	0.76
Bicep II Magnum	2.1 qt	1.63
Bicep Lite II Magnum	1.5 qt	1.0
Buctril + Atrazine	2 pt	0.5
Bullet	4 qt	1.5
Contour	1.33 pt	0.5
FulTime	4 qt	1.6
Guardsman	4 pt	1.3
Harness Xtra	2.3 qt	1.0
Leadoff	4 pt	1.3
Liberty ATZ	32 oz	0.8
Marksman	3.5 pt	0.9
Shotgun	2 pt	0.6
Surpass 100	2.5 qt	1.25